DIO-2232
DIGITAL I/O CARD

USER'S MANUAL (V1.2)

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Contents

1. FORWARD

Thank you for your selection of JAC's product DIO-2232 DIGITAL I/O card for IBM compatible industrial PC. In the field of industrial control, digital I/O is generally controlled under a microprocessor and owing to their specific consideration of industrial environment, it is quite different from the laboratory requirement.

This card is a FPGA based design and our experience in the noise immunity makes this card very stable in the noisy environment and you don't worry about computer down by external noise. we wish the card that will be helpful to your project.

DIO-2232 has 32 outputs and 32 inputs which are photo-isolated on the main card. In the wiring board , output is amplified with POWER MOS to fill different application requirements. This card also provides 3 addressing mode (Byte,Word,Index) for easy programming and downward compatibility.

This card may take as a upgrade of our 9000 series DIO card , and as usual it is good match to work with our other cards. Our DIO series card is your best choice.

Other DIO series products:
DIO-9201→16IN+16OUT digital I/O card
DIO-2248→48IN+16OUT digital I/O card
DIO-2264→64IN digital Input card

Any comment is welcome,
please visit our website: www.automation.com.tw for the up to date information.

2. PACKING LIST

2.1	DIO2232 main card	1
2.2	DIO2232 wiring board	1
2.3	SCSI Ⅱ 68 PINCABLE(1.5m)	1
2.4	Accessories	1
2.5	DEMO CD	1

3. FEATURES

3.1 I/O mapped with system interface through ISA Bus

3.2 All of inputs with photo-coupler isolation

3.3 LEDs for corresponding status indication

3.4 8 digits per I/O group with Green LED at first digit

3.5 Pluggable connector easy hook external wire

3.6 Jumper selectable address mode：

- Index mode (occupied 4 I/O location)
- Byte/Word mode (occupied 8 I/O location)

3.7 Power MOS type output: drive high speed DC load

4. SPECIFICATIONS

4.1 DIO-2232 MAIN CARD

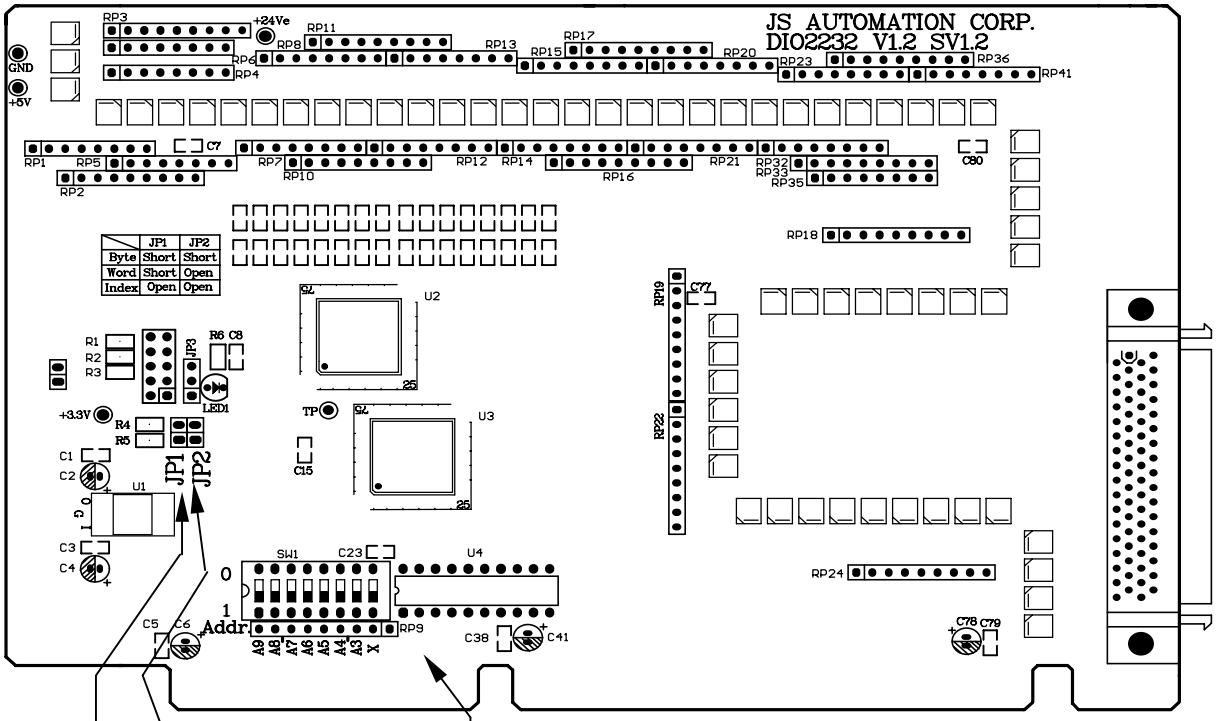
4.1.1 Input photo-coupler isolation voltage — 2500Vac 1Min
4.1.2 Insulation resistance — 100M Ohm (min) at 1000Vdc
4.1.3 Data width — Jumper selectable for 8 bits or 16 bits
4.1.4 Per I/O addressing — 4 locations for Index mode
8 locations for byte/word direct I/O mode
4.1.5 Base address with range — 100H to 3FFH,increment by 4 for Index mode
increment by 8 for direct i/o mode
4.1.6 Input channel — 32 ea of ON/OFF switching
4.1.7 Output channel — 32 ea of ON/OFF switching
4.1.8 Switching speed — 2.2KHZ max. (with on board debounce circuit)
4.1.9 Input “ON” state — 2.8V(max) 4.5ma(min)
4.1.10 Input “OFF” state — 8V(min) 3ma(max)
4.1.11 I/O connector — 68 pin female mini scsi connector
4.1.12 Wiring board — 1 with round cable hook to main card
4.1.13 External supply — DC 24± 4V
4.1.14 Operation temperature — 0 to 70° C
4.1.15 Operation humidity — RH5~95%, non-condensed
4.1.16 Dimension — 183(W)*122(H)mm

4.2 DIN RAIL MOUNTED WIRING BOARD

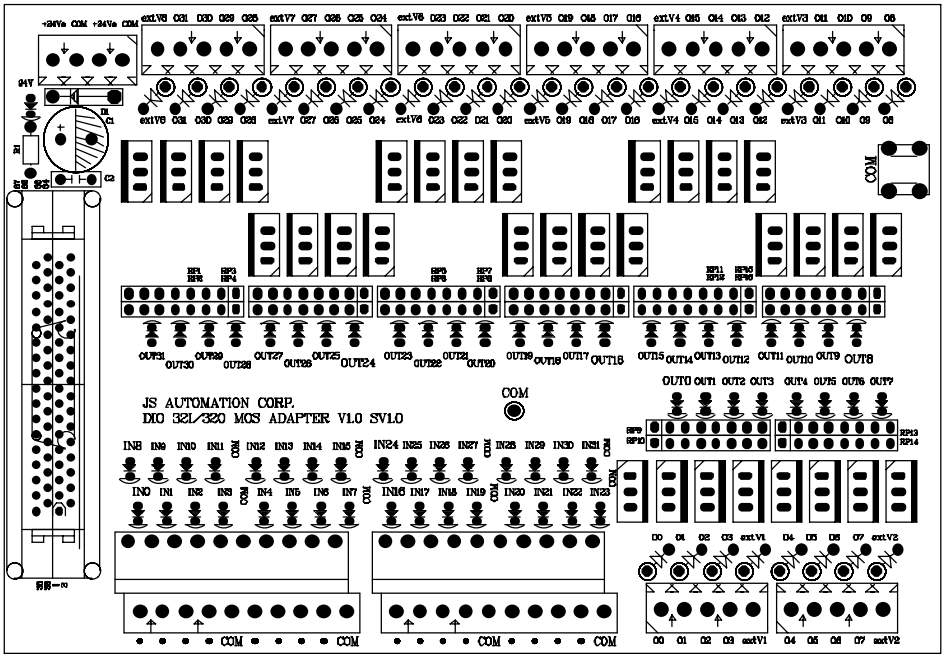
4.2.1 External supply —DC 24V± 4V
4.2.2 Input status indicator — 32 LED, 8 digit per group with Green LED at first digit
4.2.3 Output status indicator — 32 LED, 8 digit per group with Green LED at first digit
4.2.4 Power indicator — Red LED
4.2.5 Terminal — Tiny screw clamp connectors， every 4 has one common terminal.
(Different “common” for different positive power terminal)
4.2.6 Output capacity —POWER MOS output, 1A continuous、120V DC (N MOS max) 、24V DC (P MOS max)
4.2.7 Operation temperature — 0 to 55° C
4.2.8 Operation humidity — RH5~95%, non-condensed
4.2.9 Dimension — 155(W)*107(H)mm

5. LAYOUT

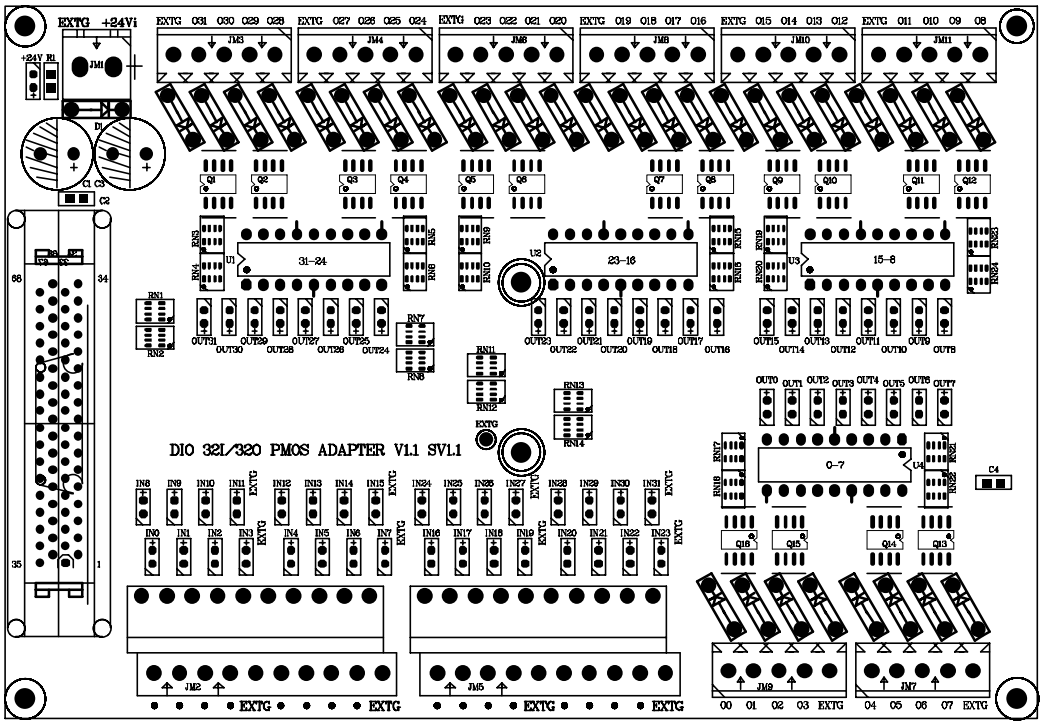
5.1 DIO2232 MAIN CARD LAYOUT



5.2 DIN RAIL MOUNTED WIRING BOARD LAYOUT (N MOS)

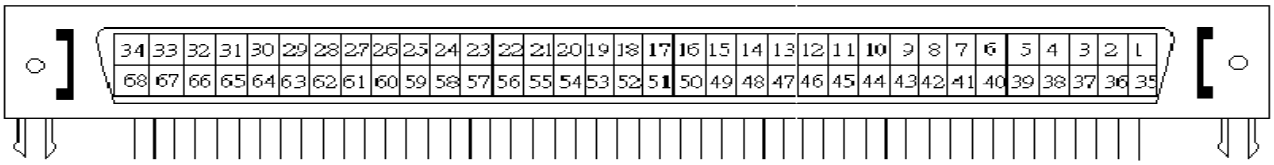


5.3 DIN RAIL MOUNTED WIRING BOARD LAYOUT (P MOS)



6. PIN DEFINITIONS

6.1 FRONT VIEW OF CONNECTOR

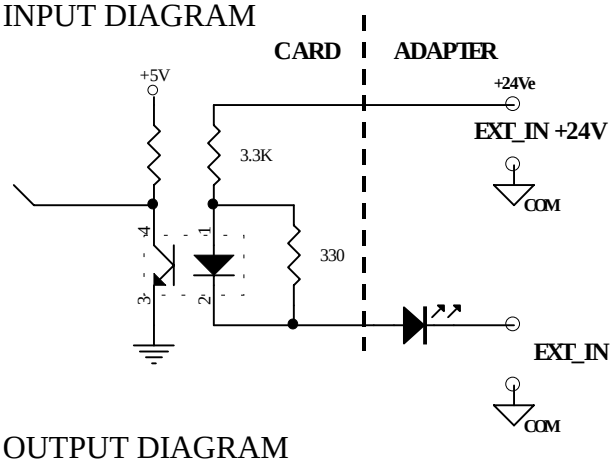


6.2 PIN DEFINITIONS

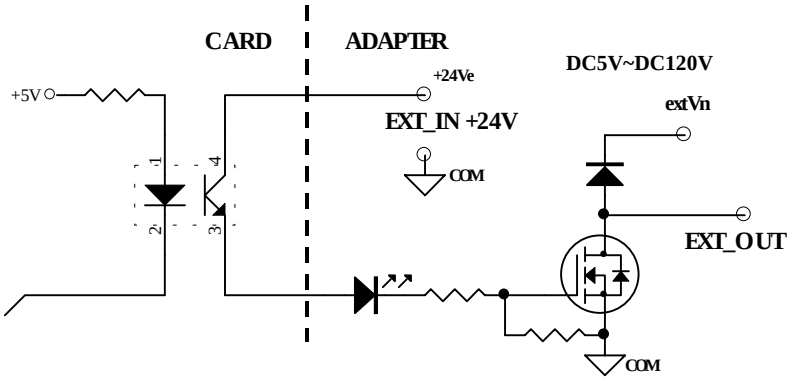
PIN	Descriptions	PIN	Descriptions
1	EXT_IN0 [External Input 0]	35	EXT_IN1 [External Input 1]
2	EXT_IN2 [External Input 2]	36	EXT_IN3 [External Input 3]
3	EXT_IN4 [External Input 4]	37	EXT_IN5 [External Input 5]
4	EXT_IN6 [External Input 6]	38	EXT_IN7 [External Input 7]
5	EXT_IN8 [External Input 8]	39	EXT_IN9 [External Input 9]
6	EXT_IN10 [External Input 10]	40	EXT_IN11 [External Input 11]
7	EXT_IN12 [External Input 12]	41	EXT_IN13 [External Input 13]
8	EXT_IN14 [External Input 14]	42	EXT_IN15 [External Input 15]
9	EXT_IN16 [External Input 16]	43	EXT_IN17 [External Input 17]
10	EXT_IN18 [External Input 18]	44	EXT_IN19 [External Input 19]
11	EXT_IN20 [External Input 20]	45	EXT_IN21 [External Input 21]
12	EXT_IN22 [External Input 22]	46	EXT_IN23 [External Input 23]
13	EXT_IN24 [External Input 24]	47	EXT_IN25 [External Input 25]
14	EXT_IN26 [External Input 26]	48	EXT_IN27 [External Input 27]
15	EXT_IN28 [External Input 28]	49	EXT_IN29 [External Input 29]
16	EXT_IN30 [External Input 30]	50	EXT_IN31 [External Input 31]
17	EXT_OUT0 [External Output 0]	51	EXT_OUT1 [External Output 1]
18	EXT_OUT2 [External Output 2]	52	EXT_OUT3 [External Output 3]
19	EXT_OUT4 [External Output 4]	53	EXT_OUT5 [External Output 5]
20	EXT_OUT6 [External Output 6]	54	EXT_OUT7 [External Output 7]
21	EXT_OUT8 [External Output 8]	55	EXT_OUT9 [External Output 9]
22	EXT_OUT10 [External Output 10]	56	EXT_OUT11 [External Output 11]
23	EXT_OUT12 [External Output 12]	57	EXT_OUT13 [External Output 13]
24	EXT_OUT14 [External Output 14]	58	EXT_OUT15 [External Output 15]
25	EXT_OUT16 [External Output 16]	59	EXT_OUT17 [External Output 17]
26	EXT_OUT18 [External Output 18]	60	EXT_OUT19 [External Output 19]
27	EXT_OUT20 [External Output 20]	61	EXT_OUT21 [External Output 21]
28	EXT_OUT22 [External Output 22]	62	EXT_OUT23 [External Output 23]
29	EXT_OUT24 [External Output 24]	63	EXT_OUT25 [External Output 25]
30	EXT_OUT26 [External Output 26]	64	EXT_OUT27 [External Output 27]
31	EXT_OUT28 [External Output 28]	65	EXT_OUT29 [External Output 29]
32	EXT_OUT30 [External Output 30]	66	EXT_OUT31 [External Output 31]
33	+24V [External DC24V power]	67	+24V [External DC24V power]
34	+24V [External DC24V power]	68	+24V [External DC24V power]

7. I/O INTERFACE DIAGRAM

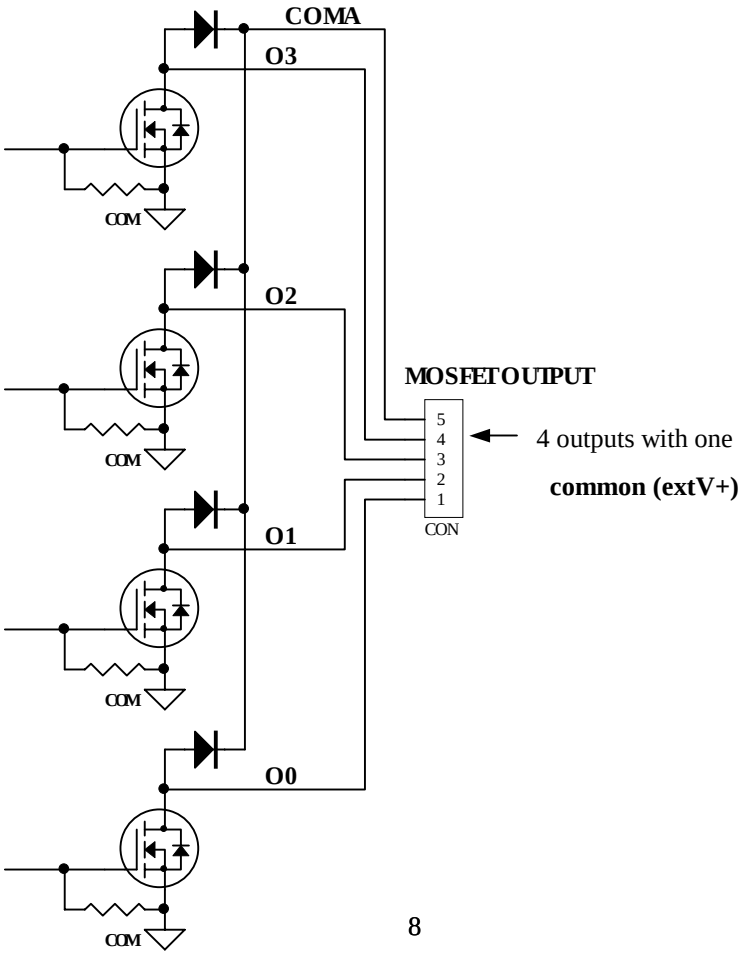
7.1 INPUT DIAGRAM



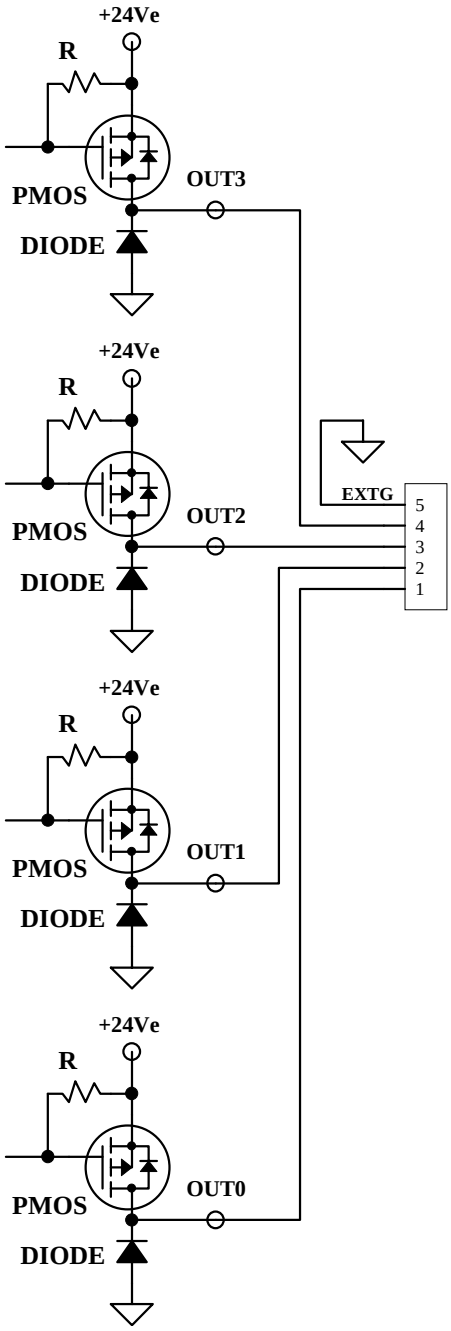
7.2 OUTPUT DIAGRAM



7.3 WIRING BOARD OUTPUT DIAGRAM (N MOS)

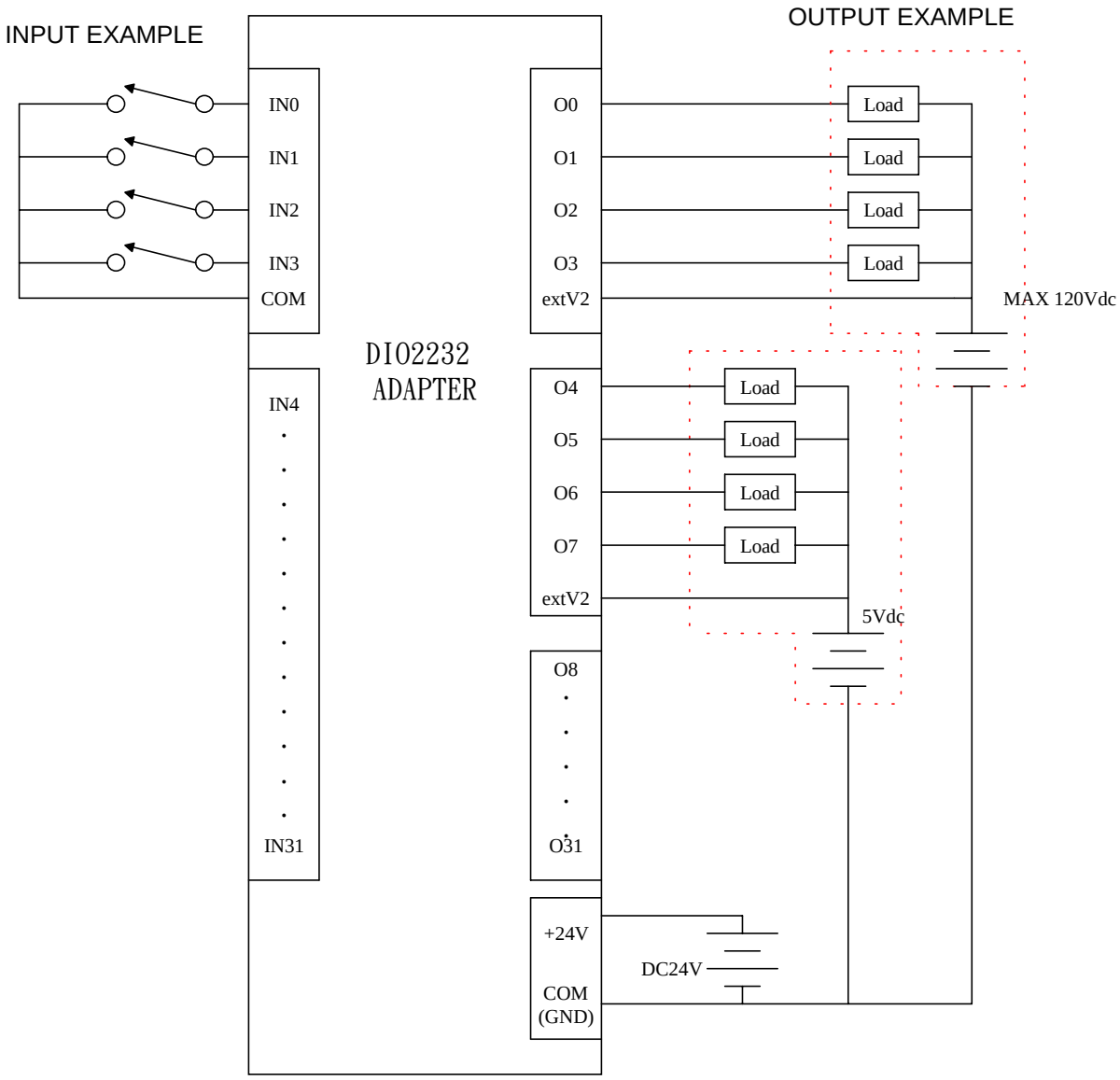


7.4 WIRING BOARD OUTPUT DIAGRAM (P MOS)



8. EXTERNAL WIRING DIAGRAM

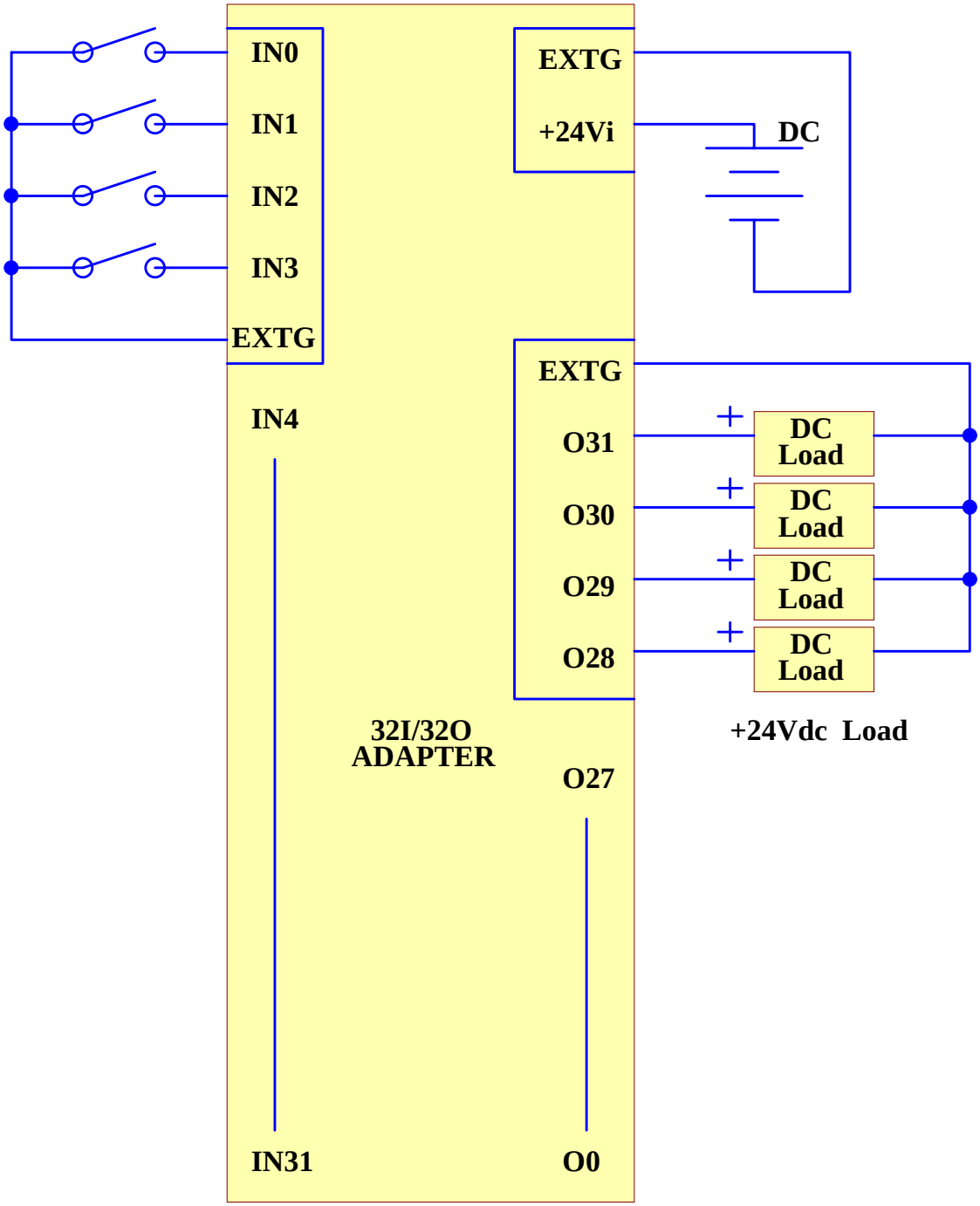
8.1 EXTERNAL WIRING DIAGRAM **(N MOS)**



If different group of output use different voltage source, please make sure to connect the V- together to the ground of external DC24V power supply.

8.2 EXTERNAL WIRING DIAGRAM **(P MOS)**

INPUT EXAMPLE **OUTPUT EXAMPLE**



9. HARDWARE SETTINGS

9.1 I/O BASE ADDRESS SETTINGS

Refer to sec. 5.1 main card layout , the DIP SW for I/O base address setting.

There are 3 addressing mode for DIO2232 , but only 4 locations for index addressing mode and 8 locations for byte or word I/O addressing mode.

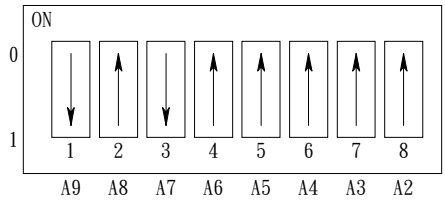
The DIP#1 for A9，DIP#2 for A8，and so forth. DIP switch upside mean “0”, and down side means “1”.

For example, to set I/O address at 280H:

DIP#1	DIP#2	DIP#3	DIP#4	DIP#5	DIP#6	DIP#7	DIP#8
A9	A8	A7	A6	A5	A4	A3	A2
1	0	1	0	0	0	0	X

X：IGNORED (byte/word mode ignored)

DIP SW SETTING：(280H)



9.2 ADDRESSING MODE SETTING

JP1，JP2 are used for addressing mode settings:

Addressing mode	Data width	**JP1**	**JP2**
Direct I/O	8Bit/Byte	short	short
Direct I/O	16Bit/Word	short	open
Indirect(Index)	16Bit/Word	open	open

10. OPERATIONS

10.1 BASICS

10.1.1 8- Bit direct output/input mode:

CPU direct read/write data (width 8 bit) from/to input/output port.

10.1.2 16- Bit direct output/input mode:

CPU direct read/write data (width 16 bit) from/to input/output port.

10.1.3 16- Bit indirect output/input mode:

CPU read/write data (width 16 bit) from/to input/output port through index addressing. (Ref. sec. 10.5)

10.2 DEFINITIONS

10.2.1 Index_Reg[1..0]：Index register，2 bit long

Index register for read/write I/O's in index mode. This card has 64 bit I/O, which are grouped as port0[0..15], port1[16..31],port2[32..47],port3[48..63].

10.2.2 WORD[3..0][15..0]： Input／Output WORD

[3..0] means group, i.e. WORD[3]～WORD[0], and [15..0] means data width (Data width is 16 bits).

10.3 OPERATION OF 8- BIT DIRECT OUTPUT/ INPUT MODE

10.3.1 Hardware setting

mode	JP1	JP2
8- Bit direct output/input mode	short	short

10.3.2 Address bus and data bus mapping

In 8-Bit /Byte direct I/O mode, the Data_Bus[15..8] is tri-state.

I/O address	data	I/O bit	I/O	
Base + 0	BYTE[0][7..0]	IN_7 ～IN_0	input	X
Base + 1	BYTE[1][7..0]	IN_15 ～IN_8	input	X
Base + 2	BYTE[2][7..0]	IN_23 ～IN_16	input	X
Base + 3	BYTE[3][7..0]	IN_31 ～IN_24	input	X
Base + 4	BYTE[4][7..0]	OUT_7 ～OUT_0	Read Back	output
Base + 5	BYTE[5][7..0]	OUT_15 ～OUT_8	Read Back	output
Base + 6	BYTE[6][7..0]	OUT_23 ～OUT_16	Read Back	output
Base + 7	BYTE[7][7..0]	OUT_31 ～OUT_24	Read Back	output

10.4 OPERATION OF 8- BIT DIRECT OUTPUT/ INPUT MODE

10.4.1 Hardware setting

mode	JP1	JP2
16- Bit direct output/input mode	short	open

10.4.2 Address bus and data bus mapping

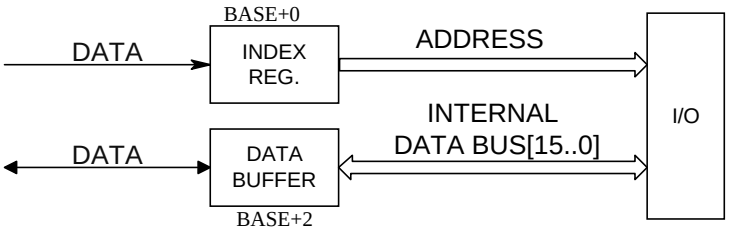
I/O address	data	I/O bit	I/O	
Base + 0	WORD[0][15..0]	IN_15 ～IN_0	input	X
Base + 2	WORD[1][15..0]	IN_31 ～IN_16	input	X
Base + 4	WORD[2][15..0]	OUT_15 ～OUT_0	Read Back	output
Base + 6	WORD[3][15..0]	OUT_31 ～OUT_16	Read Back	output

10.5 OPERATION OF 16- BIT INDEX INPUT/OUTPUT MODE

10.5.1 Hardware setting

mode	JP1	JP2
16- Bit index input / output mode	open	open

10.5.2 Operation diagram of index mode:



10.5.3 Index register: write only register at address base+0, the data written as address of the I/O port.

Address	Data write to index register	I/O	
Base + 0	Data:=0	input	X
Base + 0	Data:=1	input	X
Base + 0	Data:=2	X	output
Base + 0	Data:=3	X	output

10.5.4 Operation of 16- Bit index input / output mode:

Data in index register	I/O address	Data	I/O bit	I/O	
Index_Reg:=0	Base + 2	WORD[0][15..0]	IN_15 ～IN_0	input	X
Index_Reg:=1	Base + 2	WORD[1][15..0]	IN_31 ～IN_16	input	X
Index_Reg:=2	Base + 2	WORD[2][15..0]	OUT_15～OUT_0	Read Back	output
Index_Reg:=3	Base + 2	WORD[3][15..0]	OUT_31~OUT_16	Read Back	output

11. APPLICATIONS

11.1 Accept：- P.B./M.S./EMG./Contact- Start/Stop/Limit swith/sensor
- Interlock/selective Sw.- Proximity switch
- Aux. contact of transducer/detector

11.2 As I/O of S/W PLC Controller

12. PROGRAMMING EXAMPLES (DEMO.)

12.1 BYTE MODE OUTPUT EXAMPLE (C LANGUAGE)

```
//          Source of   D32-BYTE.C                          //

//Use Byte mode of    DIO-2232 to output    OUT0
//and read    IN30 to display on CRT

        #include <dos.h>
        #include <conio.h>
        #include <ctype.h>
        #include <stdio.h>

void main()        // begin
{
  char in_buffer;//declare input buffer
  clrscr();    // clear screen

  printf("Please short JP1 JP2 for switch to BYTE MODE control..\n");
  // JP1,JP2 short for BYTE mode

  printf("Please set base address = 280h\n");        //card base address at 280H

  printf("Bellow set output0 ative.\n");              //OUTPUT0 active

  outport(0x284,0x01);
  //Write to base+4 to activate OUTPUT0 and OUTPUT1 to OUTPUT7 not activate.
  //Note: If only one bit (say OUTPUT0) to change state but other don't, you may keep a
  // output buffer (CHAR)BUFFER and operate the change bit with the buffer then copy this
  // buffer to output.

  getch();      //wait for keyin

  printf("Bellow read input30 status..\n");          //input INPUT30

  in_buffer = inport(0x283);                         //read base+3 (for IN30) to input buffer

  in_buffer = in_buffer >> 6;                        //shift IN30 to bit 0

  in_buffer = in_buffer & 0x01;                      //mask off other bits

  printf("Input30 status = %d",in_buffer);        //print at screen
}    // program end
```

12.2 WORD MODE OUTPUT EXAMPLE (C LANGUAGE)

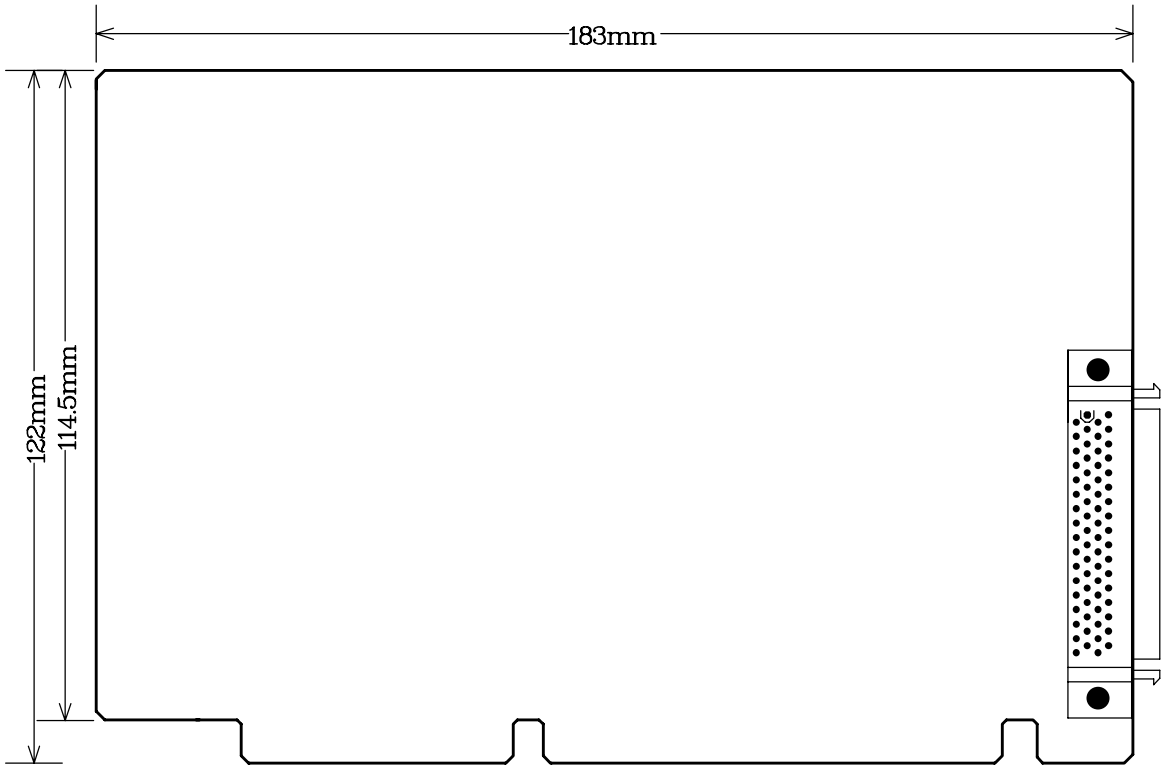
```
//          source of   D32-WORD.C        //

// Use Word mode of    DIO-2232 to output    OUT0
// and read    IN30 to display on CRT

        #include <dos.h>
        #include <conio.h>
        #include <ctype.h>
        #include <stdio.h>

void main()        // begin
{
  unsigned int in_buffer;// declare input buffer
  clrscr();    // clear screen

  printf("Please short JP1,open JP2 for switch to WORD MODE control..\n");
  // JP1 short JP2 open for WORD mode

  printf("Please set base address = 280h\n");           // card base address at 280H


  printf("Bellow set output0 ative.\n");                // OUTPUT0 active

  outpw(0x284,0x0001);
  //Write to base+4 to activate OUTPUT0 and OUTPUT1 to OUTPUT15 not activate.
  //Note: If only one bit (say OUTPUT0) to change state but other don't, you may keep a
  // output buffer (unsigned int)BUFFER and operate the change bit with the buffer then copy
  // this buffer to output.


  getch();      // wait for keyin

  printf("Bellow read input30 status..\n");             // input INPUT30

  in_buffer = inpw(0x282);                  //read base+2(for IN30) to input buffe

  in_buffer = in_buffer >> 14;              // shift IN30 to bit 0

  in_buffer = in_buffer & 0x0001;           // mask off other bits

  printf("Input30 status = %d",in_buffer);          // print at screen
} // program end
```

12.3 INDEX MODE OUTPUT EXAMPLE (C LANGUAGE)

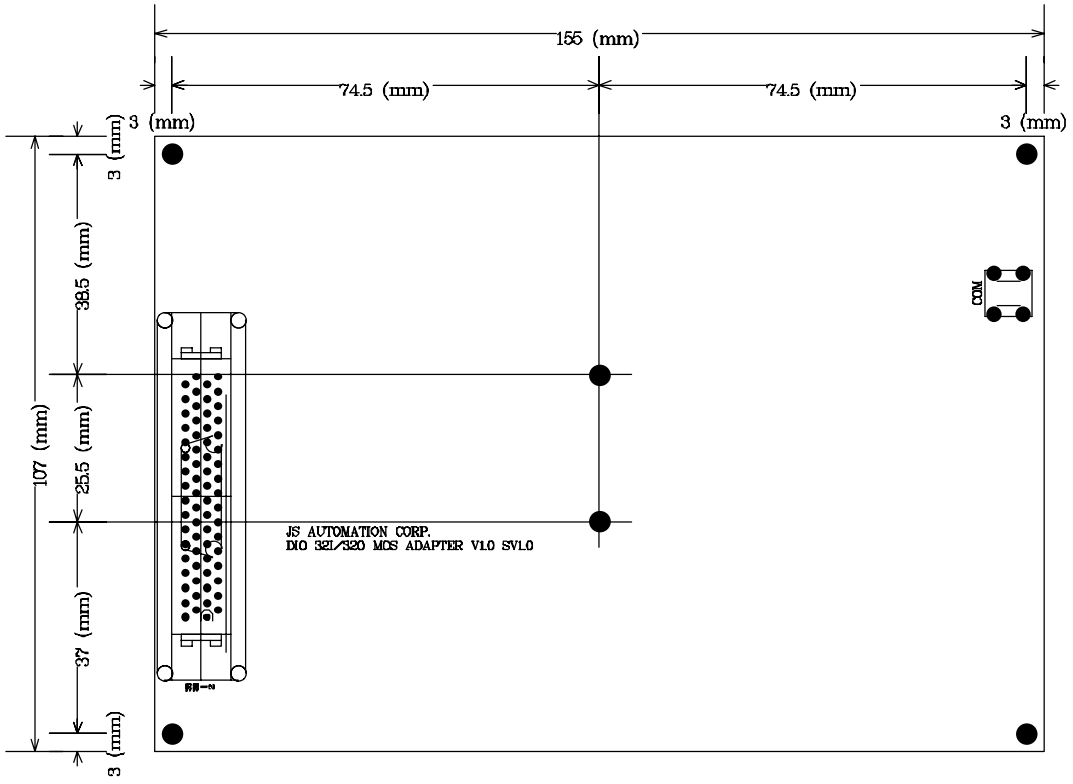
```
//          Source of   D32-INDEX.C        //

// Use Index mode of    DIO-2232 to output    OUT0
// and read    IN30 to display on CRT

#include <dos.h>
#include <conio.h>
#include <ctype.h>
#include <stdio.h>

void main()        // begin
{
  unsigned int in_buffer;// declare input buffer
  clrscr();    // clear screen

  printf("Please open JP1 & JP2 for switch to WORD MODE control..\n");
  // JP1,JP2 open for Index mode

  printf("Please set base address = 280h\n");           // card base address at 280H

  printf("Bellow set output0 ative.\n");               // OUTPUT0 active

  //.....……..
  outpw(0x280,0x02); //write to 280H to setup index register to port2

  outpw(0x282,0x0001);              // OUTPUT0 active
//.....…….
//Write to base+2 to activate OUTPUT0 and OUTPUT1 to OUTPUT15 not activate.
//Note: If only one bit (say OUTPUT0) to change state but other don't, you may keep a
// output buffer (unsigned int)BUFFER and operate the change bit with the buffer then copy
// this buffer to output.

  getch();      // wait for keyin

  printf("Bellow read input30 status..\n");             // input INPUT30

 //.....…….
  outpw(0x280,0x01); //setup index to 1 (input port2)

  in_buffer = inpw(0x282);       //read data
 //.....……..

  in_buffer = in_buffer >> 14;                // shift IN30 to bit 0

  in_buffer = in_buffer & 0x0001;            // mask off other bits

  printf("Input30 status = %d",in_buffer);        // print at screen
 } // program end
```

13. DIMENSIONS

13.1 DIO2232 MAIN CARD DIMENSION



13.2 DIN RAIL MOUNTED WIRING BOARD DIMENSION



14. ORDER INFORMATION

PRODUCT	DESCRIPTIONS
DIO-2232	Main card: 32 In and 32 Out with photo-coupler isolated
DIO-2232 DMO	Demo program of DIO-2232 card for DOS (free with user manual)
DIO-2232 WIN	Dll (VB/VC/C++ Builder) of DIO-2232 card for Win95/98/NT
DIO-2232 LBV	Vi of DIO-2232 card for LabVIEW i
DIO-2232 DIN	DIN-rail mounted wiring board for 32 inputs and 32 Power MOS output